

Introduction to Food Technology

Introduction to Food Technology

Key concepts, major areas, and practical applications

1. What Is Food Technology?

Aspect	Description
Definition	The scientific and engineering discipline that applies principles of chemistry, microbiology, engineering, and nutrition to the production, preservation, packaging, and distribution of food.
Goal	Deliver safe, nutritious, affordable, and appealing foods that meet consumer expectations and regulatory standards.
Scope	From raw material handling to processing, packaging, storage, and waste management.

2. Core Scientific Foundations

Discipline	Role in Food Technology
Food Chemistry	Analyzes composition (proteins, lipids, carbohydrates, vitamins, minerals) and reactions (Maillard browning, oxidation, enzymatic changes).
Food Microbiology	Studies microorganisms that cause spoilage, foodborne illness, and those used as starters or probiotics.
Food Physics	Examines heat/mass transfer, rheology, texture, and mechanical properties of foods.
Nutrition Science	Links food composition to human health, guiding formulation of functional and fortified foods.
Engineering	Designs equipment (extruders, dryers, mixers) and processes (thermal, non-thermal) for scale-up and efficiency.

3. Major Processing Operations

Process	Principle	Typical Applications
---------	-----------	----------------------

Introduction to Food Technology

Thermal Processing	Heat kills pathogens & inactivates enzymes.	Canning, pasteurization, UHT milk, sterilized soups.
Freezing & Cold Chain	Low temperature slows microbial growth & enzymatic activity.	Ice cream, frozen vegetables, ready-to-eat meals.
Drying/Dehydration	Removes water & reduces activity & weight.	Fruit leathers, powdered milk, jerky.
Fermentation	Controlled microbial metabolism produces acids, alcohol, or flavor compounds.	Yogurt, cheese, kimchi, sourdough, beer.
High Pressure Processing (HPP)	300–600 MPa pressure disrupts microbial cells without heat.	Fresh juices, guacamole, ready-to-eat salads.
Extrusion	Combines heat, pressure, shear to shape and cook material.	Breakfast cereals, snack pellets, meat analogues.
Encapsulation	Entraps bioactives (vitamins, probiotics) in protective matrices.	Functional beverages, fortified oils.

4. Food Safety & Quality Assurance

Element	Key Practices
Hazard Analysis & Critical Control Points (HACCP)	Identify hazards, set critical limits, monitor, verify, record.
Good Manufacturing Practices (GMP)	Facility design, sanitation, employee hygiene, equipment maintenance.
Shelf Life Testing	Accelerated storage studies, microbial counts, sensory evaluation.
Quality Control (QC) Tools	ASTM/ISO standards, statistical process control (SPC), rapid microbiological methods.
Regulatory Frameworks	FDA (US), EFSA (EU), Codex Alimentarius – labeling, additives, contaminants.

5. Packaging Technologies

Type	Function	Example Materials
------	----------	-------------------

Introduction to Food Technology

Barrier Packaging	Limits oxygen, moisture, light.	Metallized PET, EVOH films.
Active Packaging	Interacts with food to extend shelf life (e.g., oxygen scavengers, antimicrobial coatings).	sachets with iron powder, chitosan coatings.
**Smart Packaging		